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DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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THIS QUESTION OF CALENDAR REFORM.

By J. R. Gilley.

IN discussing this question of calendar reform I should like to divide my address into four general divisions: first, a brief historical sketch leading up to and the introduction of the Gregorian Calendar; second, the defects and disadvantages of our calendar and reasons for reform; third, an outline of two plans of revision; and fourth, a statement of the progress of the calendar reform movement throughout the world.

It is no idle exaggeration to say that the calendar is the most universally used of all systems of measurement; it is the most humanizing factor in life; it is the force by which all living is directed and regulated and it has not been remodelled for 353 years.

The present era places great emphasis on precision yet our present yardstick of time measurement uses an arrangement of weeks, months and years that was devised in an age when scientific accuracy had not even been imagined.

It you will cast your mind back over history you will realize that the calendar is older than civilization itself and so is calendar reform. The need for calendar knowledge compelled primitive man to study the heavens and thus the science of astronomy was born. Strange to relate, astronomical knowledge was developed independently in many parts of the world. The Babylonians, Egyptians and other ancient races in Europe, Africa, Asia and perhaps also in America, were familiar with the relationship between the stars, moon and the sun, and their effect on the seasons.

Six thousand years ago the Egyptians had a year of 12 months of 30 days each with an additional five days which were devoted to religious festivals. From this system, descended through the Romans, has come our calendar of to-day. When Julius Cæsar decided to reform the complicated calendar of that day he called in the Egyptian Sosigenes who formulated what was known as the Julian Calendar, which was adopted in 46 B.C. This calendar counted the solar year as 365¼ days. Every fourth year was to be a leap year with 366 days, the ordinary year having 365 days. The months had alternately 31 and 30 days with February having 29 days and 30 in leap year.

The Julian Calendar endured for about 16 centuries, the only alterations being made a few years later than 46 B.C. by Augustus Cæsar who could not bear the thought that the month dedicated to him should have only 30 days while July, which was dedicated to Julius Cæsar, had 31. Consequently, a day was taken from February and given to August.

The complexity of all calendars has been due to the true length of the solar year being 365 days, 5 hours, 48 minutes, 46 1/7 seconds. The difference between the true length of the year and the Julian length, which is 11 minutes 13 6/7 seconds, caused a gain of a whole day in every 128 years. By 1582 A.D. this discrepancy amounted to over 10 days and Pope Gregory XIII, with the aid of his astronomers, mathematicians and priests, decided to rectify the errors of the Julian Calendar.

The three major reforms introduced at this time were:

1. Ten days were dropped by making October 15th follow October 4th.
2. Three leap years were to be omitted every 400 years, i.e., only those centurial years which were divisible by 400 should be leap years. This reduced the error in our present calendar to one day in 3,300 years.
3. That January 1st should be New Year's Day.

The Gregorian Calendar, as it was called, was adopted at once by the Catholic countries, Italy, France, Spain, Portugal and in the following year by Switzerland and the Netherlands. In 1609 it was

adopted by the Protestant states of Germany and in 1752 by England and her colonies, including the United States. Recent adoptions have been made by Japan in 1873, China in 1912, Turkey in 1917, Russia in 1918, Serbia in 1919 and Greece in 1923.

The adoption of the Gregorian Calendar in England was due to the efforts of Lord Chesterfield and it might be of interest for me to read to you the story of the famous speech in which he introduced the Bill in the House of Lords. In a letter to his son he says:

> I consulted the best lawyers and the most skilful astronomers, and we cooked up a Bill for that purpose. But then my difficulty began; I was to bring in this Bill, which was necessarily composed of law jargon and astronomical calculations, to both of which I am an utter stranger. However, it was absolutely necessary to make the House of Lords think I knew something of the matter, and also to make them believe that they knew something of it themselves, which they do not. For my own part, I could just as soon have talked Celtic or Sclavonian to them as astronomy, and they would have understood me fully as well; so I resolved to do better than speak to the purpose, and to please instead of informing them.
>
> I gave them, therefore, only an historical account of calendars, from the Egyptian down to the Gregorian, amusing them now and then with little episodes; but I was particularly attentive to the choice of my periods, to my elocution, to my action. This succeeded, and ever will succeed; they thought I informed because I pleased them; and many of them said that I had made the whole very clear to them, when, God knows, I had not even attempted it.

Our calendar has been in use now for over three and a half centuries without being altered and thoughtful people in more than 20 of the leading nations of the world are now convinced that it has outlived its usefulness. Their realistic attitude is evidenced by the formation of many energetic societies and associations for the promotion of calendar revision.

Let us freshen our minds with regard to the defects in the calendar.

1. The difference in the length of the months—seven months of 31 days, four of 30 and one of 28 (in Leap Year 29).
2. The quarters and half years are unequal in length and, with the exception of the second quarter, never contain an even number of complete weeks.
3. In any year, the days of the week change to different dates

from one month to the next (the exception to this being the first 28 days of March, which are identical with the 28 days of February in ordinary years).

4. From one year to the next, the days of the week in corresponding months change to different dates.
5. From one year to the next, the dates for Sundays, Easter and other holidays change to different days of the week, or in cases where the holiday is determined by a day of the week, it changes to a different date of the month.

Obvious disadvantages produced by these defects are:

1. In religious, commercial, industrial, agricultural, social and family life, there is an incessant varying time friction between weekly and monthly affairs. This friction causes many inconveniences in personal finances and arrangements for all classes of people.
2. The months and quarters are not accurately comparable for accounting purposes nor for business, health and scientific statistics unless laborious adjustments are made.

Calendar irregularities crop up in finance, banking, accounting, education, transportation, insurance, publishing, labour, production, real estate, hotel administration and many other activities. I shall comment on a few instances.

Every year educators are confronted with the difficult task of arranging the university or school calendar, which is further complicated by attempting to make Easter, Christmas and other holidays fall efficiently into the school year.

Transportation authorities throughout the world are vitally interested in this subject. A reformed calendar would prove of immediate and lasting benefit to all forms of transportation, especially in the stabilization of holidays, increased accuracy of all statistical information and the simplification of transportation schedules.

What the clock is to the daily newspaper reporter, the calendar is to the editor of a monthly magazine. The editor must schedule a deadline for such material as editorial and statistical texts and advertising and mailing dates. At present the deadline date or day is always roving and during 1936 the mailing date will roam so

madly across the calendar that it will cover every day in the week. Publishers have everything to gain from calendar reform.

3. Periodical events cannot be fixed with precision. If fixed by the date of the month, the date in some years will fall on a Sunday or if fixed by the day of the week, the date will vary from one to seven dates in different years. The controversy over the date of Thanksgiving Day this year in Canada aptly illustrates that in religious, economic and social life our present calendar is most inadequate. It is no exaggeration to say that the business and social life of the whole country was dislocated this year when the day and date of Thanksgiving was changed from Monday to a mid-week day (Thursday).

   It has been recognized for many years that a holiday occuring in mid-week seriously disrupts the affairs of transportation companies, commercial concerns and educational institutions. May I quote figures to illustrate how Thanksgiving this year affected the attendance in the Great Hall in Hart House. There was a decrease in attendance as follows:

   Wednesday, preceding Thanksgiving—11 per cent.
   Thursday, Thanksgiving Day .....—89 " "
   Friday, following Thanksgiving .....—33 1/3 " "
   Saturday, following Thanksgiving....—41 " "
   Sunday, following Thanksgiving.....—20 " "
   Monday, following Thanksgiving.....— 4 " "

   Surely the result of decreased attendance for six consecutive days is a striking example of financial loss due to defects in our calendar. Had this holiday occurred on Monday, three days only would have been affected.

4. The instability of Easter, which now wanders over a period of 35 days, from March 22nd to April 25th, is another serious disadvantage. While it is realized that Easter could be stabilized without calendar revision, it is, however, more or less universally agreed that no definite action will be taken until the calendar itself is revised. The wandering Easter date not only affects the fixing of movable feasts depending on Easter but also makes it difficult to synchronize trade and

business requirements in all their varied branches. Schools, universities and law courts are handicapped at present in planning their affairs.

So much for the defects and disadvantages.

It is impossible to rectify all these defects in one plan of revision and out of over 500 plans of revision suggested to the sub-Committee on Communications and Transit of the League of Nations only two are now being seriously considered, i.e.,

13-Month Plan.

12-Month, Equal-Quarter Plan.

There are certain advantages common to both plans:

1. Each would provide for a perpetual fixed calendar.
2. Both advocate commencing in a year when Sunday falls on January 1st. This will occur in 1939 and in 1950.

13-Month Plan.

Every month would contain 28 days.

The last day of the year (Year Day) would follow December 28th.

A new month, "Sol", would be inserted between June and July.

Leap Day, which would probably be fixed at the end of June, would be a week day and a holiday.

Advantages	*Disadvantages*
1. Months would be identical as to length, date numbers and sequence of the days of the week.	1. The psychological and practical difficulties in the introduction of thirteen months.
2. Month ends would coincide with week-ends.	2. Sentiment against the thirteenth month, "Sol", would be almost impossible to overcome. The change would be extremely radical.
3. Each month would be an exact multiple of the week, thus assisting to harmonize weekly incomes with monthly expenditures.	3. Neither quarter nor half years would contain a whole number of months.

4. Many large industrial and commercial firms in several countries have already adopted thirteen periods of four weeks for accounting purposes.

4. Thirteen is not evenly divisible by two, three, four or six.

5. The establishment of comparative statistics relating to the pre-reform era and the post-reform era would be extremely difficult, if not impossible in some cases.

12-Month, Equal-Quarter Plan.

Four months of 31 days (first month in each quarter).
Eight months of 30 days (last two months in each quarter).
Stabilizing day (Year-End Day) after December 30th.
Leap-Year Day, extra week day between June 30th and July 1st.

Advantages.

1. The World Calendar regulates the twelve-month year. It is balanced in structure, perpetual in form.
2. All holidays are stabilized and placed on Monday whenever possible. Christmas remains the same as it naturally falls on Monday, December 25th.
3. Religious customs are respected and upheld with Easter falling regularly on an established date.
4. Astronomical conditions are recognized. It acknowledges the importance of the solar year over the lunar cycles.
5. The quarterly divisions of the year conform to the four seasons as they do now. This is important for agriculture and certain seasonable businesses.
6. The twelve months are multiples of halves and quarters. The equal quarters consist of 3 months. These quarters also comprise 13 weeks or 91 days, of which 13 days are Sundays

and 78 are week-days. Each month has 26 week days. Sunday is always the first day of the week, whereby the continuity of the week is maintained.

7. The odd 365th day of the year is interpolated between December and January; the 366th day of Leap Year is set between June and July. These days are known as Year Day and Leap Day and have a week-day name, Saturday. They fall on the second day of the double Saturday, the last day of December and June. Year Day and Leap Day are designated as the second Saturday December 30th and the second Saturday June 30th with the year-date following.
8. January 1st and July 1st fall on Sunday, the first day of the week, and "wandering" Sunday is avoided. A regular rest day every week is vital for the welfare of humanity.
9. Only seven days are changed. Two days, the 29th and 30th in February, are added; the 31st day of March is taken away; to April is given a 31st day; the 31st days of May and August are eliminated; and the seventh day, the 31st of December, is converted to Year Day, an extra day, the second Saturday December 30th.
10. The twelve-month calendar is an economic saving; it does not add to existing expenses; neither does it call for an increase in labour. A chance of injustice through unnecessary fractions is avoided. All phases of living are not subordinated to commerce.
11. This Calendar, which is regular in its system, contains a certain variety within each quarter-division of the year. Thus it avoids the cut-and-dried method of a fixed, mechanical plan by giving it a flexible regularity. This gives life to its structure.
12. In the World Calendar, the revisions are few; there are no drastic reforms; and the transition into the new order is made easy by the retention of the twelve months.
13. Holidays would be stabilized in the most satisfactory manner, particularly in Canada, where the majority of the holidays would fall at the week-end. The following list illustrates a possible re-arrangement of Canadian holidays:

Easter—	Sunday, 8th April.
Victoria Day—	Friday, 24th May.
King George's Birthday—	Sunday, 3rd June (Monday holiday probably).
Leap-Year Day—	extra Saturday between June 30th and July 1st.
Dominion Day—	Sunday, 1st July (Monday holiday probably).
Civic Holiday—	Monday, 6th August.
Labour Day—	Monday, 4th September.
Thanksgiving Day—	Monday, either 9th, 16th or 23rd October or some other Monday in October or November.
Christmas Day—	Monday, 25th December.
Year-End Day—	extra Saturday between December 30th and January 1st.

Disadvantages

1. Months would not be of equal length.
2. Months would not contain an exact number of weeks.
3. Ends of months would coincide with week-ends in the last month of each quarter only.

The twelve-month plan, unlike the thirteen-month, involves practically no disturbance of ingrained customs and habits. The appearance of the calendar is unchanged. The familiar and convenient division of the year into 12 parts is retained and every day forever falls on the same date.

I have no hesitancy in saying that in all the leading countries of the world an overwhelming majority of students of calendar reform are convinced that the advantages of the 12-month equal-quarter plan outweigh by far the advantages of the 13-month plan.

I pass now to the fourth division—the progress of this movement throughout the world.

In 1923 the League of Nations' activity in calendar reform commenced when the Communications and Transit Committee undertook the study of the problem of calendar reform and the

stabilization of Easter. During the next eight years the whole question was carefully investigated and considered in all its international aspects, the work culminating in the sessions of the Fourth General Conference in 1931 at which 44 nations were represented. The committee concerned will meet again in 1936 to consider the progress made since 1931 and by this means will provide for international co-operation and action.

I repeat, that many energetic organizations have been formed to foster and guide this movement. In Canada the Rational Calendar Association was formed in July, 1934, and is a direct branch of the Rational Calendar Association of England and closely affiliated with the World Calendar Association of New York. All favour the 12-month equal-quarter plan of revision. In Canada members have been enrolled from all nine provinces and they include members of parliament, representatives of the bench, the bar, the faculties of universities, editors, church leaders and influential business men. Articles promoting reform have appeared in 40 of the outstanding newspapers in Canada this year. Twenty-eight favoured the 12-month plan and 4 were in favour of the 13-month plan. Many articles have also been published in various magazines and journals.

In Great Britain it has been the main object of the Rational Calendar Association to build up a body of authoritative and active opinion in support of the 12-month plan. Their membership has increased by over 150 per cent. in the last 18 months. Chambers of Commerce in that country are particularly enthusiastic supporters of revision and 25 individual chambers have sent resolutions to the Home Secretary urging reform. The clergy in England continue to give a large measure of support. They have been advocating for many years the adoption of a stabilized Easter. More than a year ago the Council of the Royal Statistical Society appointed a committee of distinguished statisticians to consider this question. Their report demands retention of the quarterly division of the year and condemns as impractical the 13-month plan.

The World Calendar Association of New York, with over 8,000 members, is by far the largest society organized in any country for the promotion of this movement. Being the largest group, it has taken upon itself the task of promoting a unified effort and under-

standing between the 20 far-flung committees stretching from Constantinople to Santiago, Chile, and including: Argentina, Belgium, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Denmark, England, France, Germany, Greece, Hungary, Irish Free State, Italy, Mexico, Panama, South America, Spain, Switzerland, Turkey, Uraguay. The co-ordinating effort is based on a regular programme which embraces:

1. A constant exchange of letters, giving full details of each committee's activities.
2. An exchange of printed matter.
3. An annual visit of the President of the American organization or other delegated official to as many of the committees as possible and to the League of Nations.
4. The publication of the quarterly "Journal of Calendar Reform".

Questionnaires have been sent out to typical groups of American leaders with the results as follows: The churches favoured reform by 9 to 1; the American Statistical Association favoured reform by 9 to 1; and educationalists by 9 to 1. In 1934 the Protestant Episcopal Church at their Triennial Convention, the Ninth Biennial Convention of the United Lutheran Church and the General Council of the Presbyterian Church passed resolutions favouring the 12-month plan of reform and the stabilization of Easter.

The Mexican Government ordered an official study of the subject of calendar reform in preparation for the conference in Geneva in 1936 of the section of the League of Nations which deals with calendar reform. The report of this study, which has just been published, favours adoption of the 12-month proposal. The committee summed up informed American opinion by which they were guided, as follows: The World Calendar is the most practical, economical, simple, orderly and efficient method for remedying the defects of the old calendar. The plan for a 13-month year is violent, confusing, stupid, impractical and costly.

Dr. Ismael Gajardo Reyes, Chairman of the Latin-American Committee of Calendar Reform and acting as the authorized representative of the Chilean Government, in the spring of 1935 made

a tour of most of the 14 countries in South and Central America represented on his committee. "My tour was undertaken for two main purposes," Dr. Reyes stated, "first to learn the official opinion of the leading South American Governments, second to ascertain more definitely the opinion of the Roman Catholic Church. On the latter point I was able to reach certain clear conclusions. One of these was that the Roman Catholic clergy in South America are not only informed and interested but are distinctly favourable to the adoption of the plan proposed by the World Calendar Association."

Mr. Charles C. Sutter, Director of the World Calendar Association, accompanied Dr. Reyes on his tour and he reports, "It is not too much to say that Latin-American countries now form a solid bloc which can be depended upon to appear in any future international conventions on this subject as a spearhead of advocacy of the 12-month equal-quarter plan."

Germany's interest in calendar reform was suddenly stimulated in June of this year by an official announcement, printed prominently in every German newspaper, that the Minister of the Interior, Dr. Frick, had received Mr. Erland Echlin, a representative of the calendar reform movement, and had given unqualified approval of the government to the plan for a new calendar, "providing the established number of months remains unchanged".

Active support in favour of this movement is also being promoted in many other countries.

In conclusion I should like to present the opinion of the Vatican, and of the Universal Christian Council representing the Protestant Churches of the world.

In June, 1935, a Mission of Inquiry, organized by the Rational Calendar Association of England, visited Rome in order to explore in the most thorough manner possible the attitude of the Vatican towards the proposals for a fixed Easter and a revision of the calendar. As a result of inquiries made in Rome the Mission came to the following conclusions: in part—

1. The subject of calendar reform is under constant consideration at the Vatican.
2. Easter stabilization cannot be detached from the question of general reform.

3. The mission satisfied itself that opinion in the Vatican is in favour of a 12-month system and is opposed to a 13-month year.

On August 29th, 1934, a Reuter dispatch from Copenhagen says: "At Franö, Denmark, a resolution pledging the Church taking part in the World Congress of the Universal Christian Council to co-operate in calendar reform and the stabilization of Easter was passed unanimously to-day. The Congress, under the joint leadership of Dr. S. Parkes Cadman, representing the American Churches and the Bishop of Chichester, representing the Church of England, heard a report giving the opinions of twelve hundred American clergymen on calendar reform. They were in favour of reform nine to one and in favour of a fixed Easter ten to one. They opposed the thirteen-month calendar by seven to one."

The world movement for a 12-month equal-quarter calendar is one in which all nations should be united. It is non-political and transcends all racial or nationalistic bounds. It tends towards international balance, stability and peace. I am one of those who is bold enough to hope that Canada, along with so many other countries, will be prepared to advocate the adoption of the world calendar at the Conference of the League of Nations to be held in 1936.

On the following page will be found the present day calendar for 1939 and the proposed World Calendar.

Toronto, November 5th, 1935.

THE PRESENT DAY CALENDAR

1939

(no two years alike)

JANUARY

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	..	..	..	..
..	..	..	..	..	..	..

FEBRUARY

S	M	T	W	T	F	S
..	..	..	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	..	..	..	..
..	..	..	..	..	..	..

MARCH

S	M	T	W	T	F	S
..	..	..	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	..
..	..	..	..	..	..	..

APRIL

S	M	T	W	T	F	S
..	..	..	..	..	..	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	..	..	..	..	..	..

MAY

S	M	T	W	T	F	S
..	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	..	..	..
..	..	..	..	..	..	..

JUNE

S	M	T	W	T	F	S
..	..	..	..	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	..
..	..	..	..	..	..	..

JULY

S	M	T	W	T	F	S
..	..	..	..	..	..	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	..	..	..	..	..

AUGUST

S	M	T	W	T	F	S
..	..	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	..	..
..	..	..	..	..	..	..

SEPTEMBER

S	M	T	W	T	F	S
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10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
..	..	..	..	..	..	..

OCTOBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	..	..	..	..
..	..	..	..	..	..	..

NOVEMBER

S	M	T	W	T	F	S
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	..	..
..	..	..	..	..	..	..

DECEMBER

S	M	T	W	T	F	S
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17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	..	..	..	..	..	..

THE WORLD CALENDAR

1939

(every year alike)

JANUARY

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
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FEBRUARY

S	M	T	W	T	F	S
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5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	..	..

MARCH

S	M	T	W	T	F	S
..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

APRIL

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	..	..	..	..

MAY

S	M	T	W	T	F	S
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5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	..	..

JUNE

S	M	T	W	T	F	S
..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

JULY

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	..	..	..	..

AUGUST

S	M	T	W	T	F	S
..	..	..	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	..	..

SEPTEMBER

S	M	T	W	T	F	S
..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

OCTOBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	..	..	..	..

NOVEMBER

S	M	T	W	T	F	S
..	..	..	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	..	..

DECEMBER

S	M	T	W	T	F	S
..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

THE DROUGHT IN THE MIDDLE WEST OF NORTH AMERICA*

By Isaiah Bowman

How Long Will the Drought Last?

THERE is no known way of predicting the end of a drought. There is no "apparent conformity to any law of succession" (*Kincer*) in rainfall variations. The change from a wet period to a dry period is comparatively uniform, but the time intervals between successive maxima are decidedly irregular. Regular cyclic changes in rainfall have not been identified in the records; there are pseudo-cyclic appearances. Climatic changes appear to be inevitable and to be as yet unpredictably irregular, whatever their cause. The power of forecast may one day be ours. As yet it eludes us. The periods of protracted drought have been in general from 5 to 12 years and periods of greater rainfall range from one to 5 to 60 or more years in duration. There are markeed differences in cyclic phase from region to region. One region may be wet, another dry, in a given year or period. Precipitation in the mountainous areas of the West is in closer correspondence as to amounts and times of occurrence than the lighter precipitation on the adjacent plains and basin floors.

One can safely predict for our dry West a rainfall heavier than that of the present. One can also be reasonably sure that its return is near, a matter of a few years at most, for the longer a drought lasts the surer we are (from past periods of duration) that it will soon end. The less extreme rainfall departures are local, and that means locally different; the more extreme departurese affect wider territory; and the most extreme affect most of the West and the Great Plains. It is the last-named type that we have been experiencing.

*Portion of a public lecture, illustrated with lantern slides, before the Americation Association for the Advancement of Science, at Minneapolis, Minn., June 26, 1935. Printed in full, with references, in *Science*, September 27, 1935.

Was the West Ever as Dry as it is Now?

The rainfall records west of the 100th meridian with few exceptions cover a period but 50 to 60 years in length. Accounts of lake levels, reports of the condition of the grass and the record of the differences in thickness of tree rings on adjacent slopes of the Great Basin combine to tell us that the most severe drought of that region, prior to the present one, as far back as any of the evidence goes, was in the 40's, with interrupted duration of drought from 1829 to 1852. Different parts of the region later on suffered shorter droughts at intervals. The changes in level of Goose Lake, lying across the California-Oregon boundary, are instructive. From the slides you see a part of its floor exposed and wagon tracks running across it. A track also shows across its southern end on one of the sheets of the Wheeler Survey of 1877-1878.

The disappearance of these tracks, made by the forty-niners and others, soon after progressive exposure in the period about 1920-1927, supports the presumption that they were quickly covered with water soon after the lake level rose (1852 and fol.) and were not again exposed until the 1920's. Since diversion of the tributary water for irrigation would exaggerate the effects of diminished rainfall on lake level, it is safe to say that the period between 1852 and 1918 was at no time so dry as in the late 1840's and since 1918. This conclusion requires checking, region by region, to determine the extent of its application to the West generally and the Great Plains. The Goose Lake records are supported by the record of ring thicknesses in junipers in the Harney Lake region.

Is There a General Tendency Towards Increasing Dryness?

The present drought appears to be the *longest* that is recorded in the tree rings of the past two centuries, though such rings tell us almost nothing about proportional amounts of rainfall. It is, however, roughly like the drought of the 1840's in duration and possibly in intensity. We have no specific evidence that protracted droughts are now more frequent or severe than they were a century or two centuries ago. Glacier retreat may or may not indicate progressive desiccation. Much depends upon the seasonal distribution and kind

of precipitation. Much depends upon the seasonal distribution and kind of precipitation that affects glacier alimentation. There is no direct correlation between rate and amount of ice retreat on the one hand and precipitation on the other. Highly important is the fact that mountains and plains may differ markedly in precipitaion trends in the same period of time, and as yet we lack "normals" sufficiently reliable to use in determining the value of departures, in our search for a basis of forecast. The longest continuous rainfall record in the United Sates is 121 years (New Bedford, Mass.), too short to give us satisfactory evidence on secular changes in rainfall. Only uninformed boldness, not science, would venture long-range prediction as to future occurrence, duration and intensities of drought upon so short a record. One may safely predict a wetter future period than we have had for the past five years. In any event, we can not hurry the seasons. A closer spacing of rain gauges is possible and a further analysis of tree rings based on contemporaneous studies of tree growth in relation to local factors of isolation, rainfall pattern, etc.

SUNSPOT INFLUENCES IN CANADA

(Issued by the Department of the Interior, Ottawa)

AN important astronomical study and one which may in time provide a basis for valuable predictions concerning the weather and living and economic conditions is that of sunspots. These spots appear from time to time on the face of the sun and fluctuate in numbers and size in an irregular period with an average length of 11.1 years, commonly called the "eleven-year sunspot cycle". Sunspots are usually accompanied by large areas of bright clouds, high in the solar atmosphere and consequently relatively strong emitters of ultra-violet light. When sunspots are most numerous ultra-violet light reaching the earth may be double the amount received when they are scarcest. Ultra-violet light ionizes the upper atmosphere of the earth and when spots are numerous there are more aurorae, and greater disturbances in terrestrial magnetism, telegraphy, and radio than when they are scarce. Ionization promotes haziness and cloudiness in varying degrees during the progress of the sunspot cycle and serious changes in weather and effects on living things result.

Investigations at the Dominion Observatory, Ottawa, of the Canadian records of temperature, precipitation, thunderstorms, agricultural grains, grasshoppers, grouse, rabbits and fur-bearers, and measurements made at the Observatory of the annual growth-rings in trees from various places in Canada, reveal the influence of the sunspot cycle in varying extent and phase, dependent on the region. The influence is of course only an average one, and is complicated in individual years by the many other factors involved. In the long run, however, its effects are clearly indicated.

Temperatures throughout Canada are higher at sunspot minima than at maxima. The range varies from about 1 degree Fahrenheit to 4 degrees Fahrenheit with a mean value of about 2 degrees Fahrenheit. In the prairie provinces the range is high, Calgary for example showing 4 degrees Fahrenheit higher temperature at minimum than at maximum in the mean.

Thunderstorms are more numerous at sunspot minimum than

at maximum in general throughout Canada. The Toronto records show about 30 per cent. more thunderstorms at sunspot minimum than at maximum. Forest fires due to lightning consequently fluctuate in numbers, in the sunspot cycle.

Precipitation at inland points is greater at sunspot minimum than at maximum, the prairie provinces having in the mean about 50 per cent. more precipitation at minimum than at maximum of spots. At oceanic points, such as St. John's, Newfoundland, the opposite is the case, greater precipitation occurring at sunspot maximum. Other points blend these terrene and aquene reactions of opposite phase in varying degrees.

Forms of life are affected in harmony with the particular meteorological cycle in each region. At inland points the annual growth-rings of trees and the numbers of grasshoppers, grouse, and rabbits are considerably greater at or near sunspot minimum than at maximum. A range of from 17 to 27 bushels to the acre in the average of Canadian wheat, oats, barley, and rye is shown in the mean eleven-year sunspot cycle for the years 1908 to 1929, the greatest mean yield occurring near sunspot minimum, though the record is far too short for precise evaluation of the sunspot influence. Potatoes for the same interval show a 25 per cent. greater yield at sunspot minimum than at maximum. All such records should, of course, be considered for each region separately.

The last sunspot minimum occurred near the end of 1933 and the next maximum will probably be in the middle of 1938. Fuller knowledge of the sunspot cycle will, it is believed by scientists, eventually assist in permitting long range weather forecasts of a general nature, thus providing valuable information relating to forest protection, wild life conservation, and other matters of social and economic importance.

THE SUN—A SOLILOQUY*

What time the elements in the universe,
Impressed by laws which spun them into form,
And moved them in the vast, unfathomed deep,
In orbits round some central master-point,
I shot my beams with fiery violence
Athwart the sky to planets speeding round me.
And still I shine to mortal eyes so bright,
With an effulgence that doth ripe and rot.

Time, then, eons ago, was born on earth,
When followed Life, linked with companion Death,
Eager of prey and wielding keenest blade.

I speak a universal language clear,
Which thus needs no interpreter. My gifts
Are reached for, often as quick forgot,
In the unceasing press for Life, more Life!
Till comes the crumbling back again to dust,
When on the ashes I renew my task,
And the life-forms my quickening beams engender,
Bask on the whirling orbs I hold in leash.

In man-made time, a single million years
To me as 'twere the fraction of an hour,
Since I began to work upon the sky;
And during this, what changes have I wrought,
Or shall I see ere I must cease to shine!
Enough to note the plasms of the deep
Have taken other shapes in sea, on land,
In air, urged on by forces irresistible,
By eager hunger, feeding on the means
Within their reach, and being fed upon
For transformation, sustenance or destruction,
Leaving but trace of set, or willed endeavour,
Of all earth-life, all form, cycle on cycle!
And in this action hap on hap transpires
Whereby sky's mysteries are in part revealed
To seekers probing ever deep and deeper,
E'en to the confines of this vast abyss,
Where reign forever cosmic life and death,
Till when my fiery rays at last do pale,
At most do wing, and still with speed of light,
Impending fate, exhausted of my labour,
I, sighing *Finis*, ring the curtain down!

J. B. H.

Nairn Centre, Ont.

*By an octogenarian—*Editor.*

METEOR NEWS

Observations relating to meteors and meteorites are cordially invited.

Observations of the 1935 Perseids

Visual observations of the Perseids were carried out at a number of Canadian stations though, as remarked last month, these were hampered to a considerable extent by the bright moonlight and some cloudy weather. In spite of these adverse conditions many valuable reports were received. The writer is glad to see that several centres of the Society are actively taking up meteor observing. In particular should be noted the Ottawa Centre where, under Mr. M. M. Thomson and Miss M. S. Burland, observations were carried out on every fine night during the first half of August. The meteors reported by the Ottawa group far outnumber those seen at any other station. The London Centre, under the direction of Mr. Middlebrook and Prof. Kingston, also made a promising entry into the ranks of meteor enthusiasts, and observations were again received from the group of Montreal scouts that observed in 1934. The party at the Dunlap Observatory was made up almost entirely of those who had observed on several previous occasions. In all, a total of 2830 observations was received. The personnel of the various observation groups is listed in Table I. The groups have been numbered and will be referred to by these numbers.

TABLE I

PERSEID OBSERVATION GROUPS—1935

1. *Dunlap Observatory, Richmond Hill, Ont*—Miss A. A. Crutcher, G. A. Cooper I. Davidson, Miss V. E. Foster, L. Foster, Miss M. James, Miss M. E. Jupp, R. B. Laing, A. D. Misener, Miss R. J. Northcott, Miss F. S. Patterson, M. D. Stewart, J. C. Strachan.
2. *Dominion Observatory, Ottawa, Ont.*—E. Allan, Miss M. S. Burland, H. Barkley, K. Buckthought, Miss D. Denney, Miss L. Ellichuck, Miss J. Fracker, Miss E. George, J. Gillett, Miss V. Gillmor, Miss G. Jolly, J. Joynt, W. R. Knowles, G. Lane, P. O'Donnell, F. Stewart, Miss M. Sutcliffe, Miss N. Simpson, M. M. Thomson, Miss E. Waters, Miss M. Whitehurst, Miss E. Whitehurst.
3. *London, Ont.*—E. H. Anundson, Rev. W. G. Colgrove, A. Gilles, D. M. Hennigar, Miss M. Hennigar, Prof. H. R. Kingston, J. M. Kingston,

Dr. G. Magee, J. Middlebrook, Dr. H. S. Wismer, Mrs. H. S. Wismer, M. A. Wilson.

4. *Kincardine, Ont.*—A. H. Armstrong, E. S. Mackay, D. A. MacRae.
5. *Camp Bois Franc, Que.*—E. Russell Paterson, S. Baburek, D. Burgess, G. Corkran, W. Martin, J. Rielly, E. Trivett.
6. *Dwight, Ont.*—Mrs. R. M. Millman, J. M. Millman, R. N. Millman, Miss M. M. Thode.
7. *Oak Ridge, Mass.*—Miss L. E. Ballhaussen, E. M. Cook, J. Greenstein, P. M. Millman.
8. *Montreal, Que.*—J. Forbes.
9. *Labrador Coast, Nfd.*—E. E. Bossence.
10. *Crescent Beach, Ont.*—Miss F. S. Patterson.

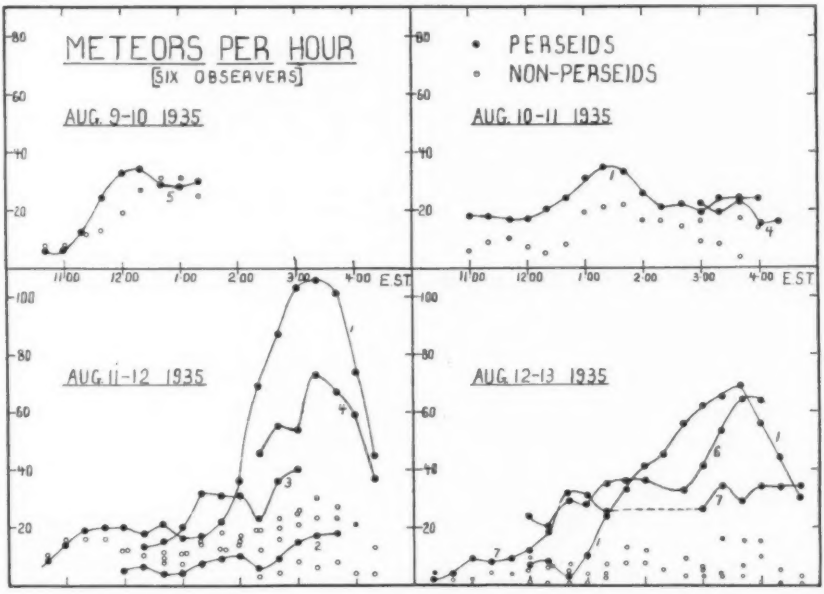
Table II contains a list of the periods over which the various groups observed, and the total number of Perseids and Non-Perseids observed in this interval. The mean hourly rate, reduced to six observers by the factors previously published in these columns, is also included. Since this rate varies appreciably during the course of the night the hourly rates for six observers are plotted in Figure 1. Here, as in diagrams previously published, each dot represents the number of meteors seen during the hour centred at that position, after this number has been reduced to six observers. Over 90 per cent. of the meteors were plotted so that the rates are somewhat lower than they would be were the observers only counting. The numbers in the figure refer to the observing groups.

The magnitude distribution for 2281 observed magnitudes is listed in Table III. There is a systematic difference between the mean magnitudes determined at the Dunlap Observatory and those of the other groups, the latter estimating the meteors a little fainter. This systematic difference was also present in 1934. The magnitude estimates for the Dunlap Observatory should be considered the most consistent from year to year since the personnel of this group has seen the least change. The effect of the moon is also clearly evident in the fainter mean magnitudes for the Ottawa observations before Aug. 9, and in the fact that the mean magnitudes for the 1934 observations, when there was no moon, are on the average a third of a magnitude fainter. This difference is over 0.4 magnitude for the Dunlap Observatory results.

An examination of the figure reveals a pronounced maximum in the hourly rates on Aug. 11-12. When compared with the 1934

plots it is seen that the hourly rates were much higher last year but, taking account of the presence of the bright moon in 1935, it is probable that approximately the same number of Perseids appeared this year as last. The fall from the maximum after Aug. 11-12 is much more definite in 1935, however.

The writer would here like to express his thanks to the many observers for the co-operation received in carrying out this pro-



gramme. The plots, many of which were made on the large scale gnomonic maps from the Ottawa Observatory, will provide a large amount of material for height computation. It is hoped that those who have just started meteor observing will find it interesting to continue it at a future date. It is certainly one of the surest ways in which the amateur, without instrumental equipment, can aid definitely in the advance of astronomical knowledge. The writer would also like to thank Miss R. J. Northcott who,

TABLE II

Date 1935	Group	No. Obs'rs	Observation Period E.S.T.	No. Meteors P	No. Meteors NP	Average Hourly Rates (6 obs.) P	Average Hourly Rates (6 obs.) NP	Weather
Aug. 1- 2	2	6	12.10- 3.10	40	105	14	38	
2- 3	2	6	11.50- 3.30	52	112	15	33	
3- 4	2	4	11.50- 3.30	49	92	19	36	
5- 6	2	8	11.50- 3.30	83	147	21	37	
6- 7	2	5	11.30- 3.30	46	71	14	22	partly cloudy
7- 8	2	4	11.30- 3.30	81	77	29	28	
8- 9	2	5	12.30- 3.30	32	68	13	41	
9-10	2	5	11.50- 3.30	14	25	5	8	partly cloudy
	5	7	10.30- 1.30	67	58	22	19	
10-11	1	12	10.50- 4.10	121	70	21	12	some haze and cloud
	4	3	11.10- 4.30	18	6	..	..	clouds
	8	1	10.40-12.10	1	4	..	..	haze
11-12	1	9	10.30- 4.30	245	97	41	16	
	2	6	11.30- 3.50	30	53	8	13	haze
	4	3	2.10- 4.30	67	8	54	7	
	3	8	12.10- 3.10	76	36	28	13	
	9	1	8.45-10.00	4	4	11	11	
12-13	1	3	11.50- 4.50	107	16	34	5	pt. cloudy till 3.00
	4	3	11.50- 1.10	11	3	13	4	
	6	4	12.00- 4.00	86	16	31	6	
	7	4	9.50- 4.50	52	9	16	3	haze, clouds
13-14	2	4	11.50- 3.30	23	19	9	7	
	3	5	12.10- 1.50	10	5	7	4	
	8	1	11.45- 1.00	4	3	11	9	
	10	1	8.10-11.30	13	7	14	7	
14-15	2	5	11.50- 3.30	10	8	..	..	haze, clouds
	8	1	10.45-12.15	1	3	..	..	
15-16	2	3	11.30- 2.30	4	8	..	..	haze, clouds
Totals				1347	1130	Total Meteors Observed 2477		

TABLE III

Mag.	−5	−4	−3	−2	−1	0	1	2	3	4	5	Totals	Mean Mag.
Perseids													
D.D.O.													
Aug. 10-13	1	1	4	15	33	71	105	134	84	19	1	468	1.33
Others													
Aug. 9-14	1	1	2	6	27	43	108	132	106	52	3	481	1.78
Ottawa													
Aug. 2- 9				1	12	41	79	89	70	42	6	340	1.91
Non-Perseids													
D.D.O.													
Aug. 10-13				1	8	27	27	57	57	4		181	1.75
Others													
Aug. 9-14					13	23	48	73	59	34	5	255	2.04
Ottawa													
Aug. 2- 9		1		1	5	32	105	149	149	101	13	556	2.38

in his absence at the Harvard Observatory during the summer, handled all correspondence concerned with mailing the maps and instructions for the observations.

P. M. M.

REVIEW OF PUBLICATIONS

La Planète Mercure et la Rotation des Satellites, by E.-M. Antoniadi. 84 pages, 6½ x 10 in., 36 fig. & 3 plates. Paris, Gauthier-Villars, 1934, Price 18 frs.

THIS is the first of a series of seven monographs on the planets being prepared by the author in which the treatment is from both the historical and the astrophysical point of view. For this task M. Antoniadi is well equipped. In the Bibliotheque Nationale in Paris he has studied the writings of the Greek philosophers and the Latin writers as well as the modern authors—French, English, German and Italian, since the 17th century—and has gathered historical references not found in any other work on astronomy. Further, since 1909 he has observed the planets with the 83-cm. refractor at Meudon, the largest in Europe.

The fact that Mercury, apart from its librations, always presents the same face to the sun, was discovered by Schiaparelli in 1889, and verified a few years later by Lowell. M. Antoniadi has confirmed it at Meudon. This, with his observations of spots on the satellites of Jupiter, leads him to the conclusion, developed in this book, that all the satellites, except the very distant ones of Jupiter and Saturn, present the same face to their planets, just as the moon does to the earth.

Chapter I deals with generalities—the elements of the planet, its dimensions, its names among various peoples, its emblems, its stellar magnitude, etc. Chapter II discusses transits of Mercury, the black drop, dark and bright aureoles and spots on the planet, and refers to the recent attempts of M. Couder to reproduce in the laboratory phenomena analogous to the spots. Chapter III deals with the "geography" of Mercury or Hermography, and the rotation of the planet. Chapter IV is entitled the atmosphere of Mercury and its "veils". The albedo, phase, polarization (including the notable researches of Lyot), spectrum and meteorology of Mercury are discussed in detail. Chapter V consists of ten pages and gives an

excellent summary of our knowledge of the physical conditions of the planet. It refers to the heat and light received from the sun, its estimated temperature, conditions on the planet, and the heavens as viewed from Mercury.

The diagrams and plates are cleverly conceived and admirably drawn.

A volume such as this devoted to each of the planets will constitute a wonderful treasurehouse and it is to be hoped that M. Antoniadi may be able to carry out his great undertaking without undue delay.

C. A. CHANT.

NOTES AND QUERIES

Communications are invited, especially from amateurs. The Editor will try to secure answers to queries.

CONQUERING THE AIR

Progress in exploring our atmosphere and in travelling through it is proceeding rapidly. Three years ago the Belgian scientist, Piccard, constructed an aluminum spherical shell and made his epoch-making flight to a height of 10½ miles, and this brilliant feat was followed by ascensions in Russia and the United States, a height given as 61,237 feet being attained. But on November 11 last this was greatly exceeded. On that date Captain Albert Stevens and Captain Orville Anderson rose from a station in South Dakota to an enormous height estimated at 74,187 feet or over 14 miles. Their full report has not been published but their recording instruments came down to earth in perfect condition and when they have been read we shall have valuable authentic results. The Russians found that at their greatest height the composition of the atmosphere seemed to be precisely similar to that at the earth's surface. This sharply called in question the theoretical deduction that there is an excess of the light gases hydrogen and helium at great heights. At the highest altitude the balloonists looked down on what is ordinarly spoken of as the sky; it was milky below but violet toward the horizon.

It is reported that on November 21 a Soviet airplane took off from near Moscow and in 65 minutes had reached a height of 13,000 metres or nearly eight miles, at which it remained twelve minutes. The temperature on the ground was 16°F. and at the greatest altitude was —81°F.

For some years there has been regular transport of passengers and mails over the land but the Atlantic and Pacific oceans presented a barrier. However, the world has been deeply impressed by the definite beginning on November 22, of scheduled trips from the United States to the Philippines. The first mighty airplane, the "China Clipper", carrying fourteen passengers and some tons of mail, reached Honolula, Midway and other way-stations and arrived at its destination according to time-table. Further, representatives of Great Britain, United States and Canada have recently been in conference working out practical details for an air service connecting these three countries. It seems that our airplanes can hop from Newfoundland to Ireland with assurance of safe arrival, but it is likely the western trip will be by way of the Azores and other Atlantic islands. Undoubtedly in coming years we shall be able to fly directly westward to America without intermediate stops but at present we have hardly reached that position.

The New Solar Telescope at Oxford

Canadian astronomers, professional and amateur, as well as many other friends, are interested in the new astronomical equipment at Oxford University where H. H. Plaskett is Savilian professor. The following account of the opening of the new telescope is taken from *The Observatory* for July, 1935:

A representative gathering of British astronomers attended the opening of the new solar telescope at the University Observatory, Oxford, by the Vice-Chancellor. Speeches were made by Prof. H. H. Plaskett, who said that the University had provided £3700 for the erection of this telescope and purchase of auxiliary apparatus, and by the Vice-Chancellor, who referred to the long history of the connection between Oxford and astronomy. The Savilian chair was among the oldest in the University, but until the nineteenth century no provision had been made by the University to enable the Savilian professor to carry out those experiments and observations which he might properly wish to perform. Bradley, perhaps the most distinguished of

Plaskett's predecessors, had been obliged to make long and tedious journeys to Kew in order to make observations. It was of interest to recall a scheme sponsored by Dr. Fell, commemorated in an unfortunate couplet, to build an observatory in Tom Tower—this had come to nothing. The University was now pleased to enable the Savilian Professor to conduct experiments suitable to his office, and the Vice-Chancellor declared the telescope open.

The solar telescope is vertical, and bears some resemblance to the two tower telescopes at Mount Wilson. It is fed by a 16-inch cœlostat, operated by a synchronous motor under remote control, and by a secondary mirror of the same aperture. The solar image is formed not by a lens at the top of the tower, but by a 12½-inch concave mirror at the foot, the image being brought down to a Cassegrain focus at the foot of the tower. The image is, of course, strictly achromatic, and is wholly free from coma; but only a part of the image, namely an area about two inches in diameter on the optical axis, is fully illuminated. The equivalent focal length is 73 feet. The cœlostat and secondary mirror are mounted on the brick pier and under the dome of the old De la Rue reflector: the former floors in this tower have been removed, and the doors and windows blocked up. It is Professor Plaskett's intention to assemble a spectroscope in the basement at the foot of the tower. He has acquired two 60° prisms and one 30° prism of 6 inches square aperture (face length 9.7 in.), which are mounted in Littrow manner with an autocollimating lens of 30 ft. focal length. The prisms are of light flint glass. Arranged in this way the dispersion is 2.6 mm. per A at wavelength 4200; the theoretical resolving power is 300,000. A heavy minimum deviation mount for the prisms has also been acquired.

To complete the spectroscope the Oxford Observatory needs a temperature control, a slit, plate holder and an optical bench in front of the slit to carry a monochromator and a guiding disc. Some hundreds of pounds are accordingly required to complete the apparatus. . . . . The solar spectrum presents a large number of pressing observational problems, bearing on which the Oxford telescope will be able to collect first class data; and its completion will mark the beginning of an advance in the history of astrophysical observations in this country.

A Fourth Edition of "Amateur Telescope Making"

It is gratifying to learn that the *Scientific American* has almost ready a new edition of the above book. Mr. Ingalls, its editor, says that the size will be practically the same but that several portions have been replaced by new material. The present writer has only admiration for this book and hopes that still more thousands of persons will be led to construct their own instruments. That there is considerable demand for glass discs and optical parts is

shown by the numerous advertisements in the "mother paper" as one may well call the *Scientific American*. Such supplies may also be obtained from the Anglo-Canadian Importing Co., New Westminster, B.C.

Standard Time Throughout the World

In this Journal for February, 1932, appeared a paper by Mr. C. C. Smith of the Dominion Observatory, Ottawa, on Standard Time in Canada. A large number of reprints were supplied and I believe there has been a good demand for them. Some years ago the U.S. Bureau of Standards issued a pamphlet entitled "Standard Time throughout the World". Modern methods of national and international communication have impressed on the ordinary person the difference in time between geographical centres and there is a continual request for information on the keeping of time. Several revisions of this pamphlet have been made, the latest being known as *Circular* C 406 and obtainable from the Superintendent of Documents, Washington, D.C., for five cents. It gives a brief historical sketch of the development of the standard time system, time-zone maps of the United States and of the world, a list of stations transmitting radio time signals, a list of the times used in several large cities, a list of the legal times used in most of the countries of the world and other information regarding standard time.

"Les Observatoires astronomiques et les Astronomes"

A supplement to this work, which appeared in 1931, will be published under the auspices of the International Astronomical Union. Directors of observatories are asked to indicate the changes which have been made in the personnel, the instruments, the programme of work and the publications. Pages extracted from the edition of 1931 will be sent to them and they will be able to insert the necessary alterations. Unattached astronomers are invited to forward changes of address and any matter concerning their activity. All information should be sent as soon as possible to Prof. P. Stroobant, director of the Royal Observatory, Uccle, Belgium.

C.A.C.

MEETINGS OF THE SOCIETY

AT VICTORIA, B.C.

October 2, 1935.—Dr. W. E. Harper presided at the meeting in the absence of Lt. Comdr. Tingley. The following were elected to membership: Mrs. E. G. Massy; Mrs. W. B. Emmerton; Miss Hope Large; Messrs. W. J. Munroe; Edmund Roberts; Henry Hodgkinson; W. Everall; Mark Trueman; N. J. Haley; William Petrie, and Dr. Andrew McKellar.

Mr. Robert Peters gave a description of current celestial phenomena, prefacing his remarks by a reference to various astronomical inaccuracies in literature of the past. Mr. Brydon announced the completion of a telescope mounting to be on display at the next regular meeting. Mr. W. Hobday announced the commencement of the class in amateur telescope making.

Dr. Harper then introduced the speaker of the evening, Dr. R. M. Petrie, and in so doing disclosed the fact that he was in a measure responsible for starting Dr. Petrie on his professional career. Dr. Petrie's subject, "The Architecture of a Star", was ably handled. The speaker noted that the study of the internal structure of stars was a comparatively new field, the method being one of mathematical investigation and the application of the laws of physics rather than one of observation. Observations could, of course, give information only on surface conditions. In 1910 Emden, a German astronomer, published a paper on the subject, the principles of which were not applied until Eddington in 1920 began his studies leading up to the "mass-luminosity" theory. The internal temperatures of various stars were believed to range from 500,000 degrees to several million degrees. Ninety-nine per cent. of stars were thought to have these high temperatures, in fact, the low temperature of our earth might be considered freakish while several million degrees would be considered average in the cosmos. Dr. Petrie showed that the stars also varied greatly in density; as example, Capella in Auriga had a density one-eighth that of water, while the dwarf star, Kruger 60, had a density 500 times that of water. The lecture was amply illustrated with slides and at its close the lecturer answered several questions.

October 30, 1953.—Lt. Comdr. Tingley presided. Mr. Robert Peters was called upon as usual for his description and discussion of current celestial phenomena. He described a simple way of calculating the diameter of the earth, reported considerable sun spot activity and pointed out the good positions of Venus and Mercury for early morning observers. The Leonid shower of meteors was due Nov. 15 to 17.

The president then announced a debate on the question "Are the planets Habitable?" by Mr. Hobday and Mr. Deacon. Mr. Deacon was called upon

first to present the negative side of the question. Mr. Deacon argued that conditions essential on any planet for the existence of life were: A solid surface cooled to suitable temperature, a true atmosphere containing oxygen and water vapour, and radiation from the sun sufficient to balance the loss of heat by radiation into space. The earth was able to sustain life only because it met these conditions and the outer planets were in too gaseous a condition to support any form of life. Mercury presented little possibility of life with its extremes of heat and cold. Venus with an atmosphere heavily laden with moisture, with a temperature of at least 104° would have unbearable humidity. Mr. Deacon doubted the Martian canals to be of artificial origin. He declared the atmosphere to be very rare, its surface desert-like and its polar caps entirely inadequate to supply sufficient moisture to sustain life. Its mean temperature, according to modern authorities, was likely 35° below zero.

Mr. Hobday then presented the affirmative side of the question. He traced the history and evolution of the planets, showing that the earth had passed through a similar stage as that of Venus at the present time and would undoubtedly in time be faced with similar conditions found on Mars. Mr. Hobday saw no reason to believe that man's intelligence would not be equal to the changing conditions and adapt itself to them while the possibility of life remained. As an example it was shown that marine life was found to exist on the lower depths of the ocean floor under conditions that seemed impossible to scientists until a recent descent to its depths revealed life in an abundance and variety of forms. Mr. Hobday declared that Lowell placed the mean temperature of Mars at 47°F., and at this temperature life could not only exist but could develop. Life on Venus would compare to that obtaining on the earth during the carboniferous era, a state of dense fogs and high temperatures. Mr. Deacon spent a few minutes in rebuttal. Following the debate Mr. Peters championed the negative, referring to the canals as largely imaginary while Mr. H. B. Brydon rose in enthusiastic support of the affirmative, describing the canals of Mars as existing in fact.

Comdr. Tingley then congratulated the speakers on their respective competent presentations and asked the audience to vote with a result that a large majority supported the affirmative view.

GORDON SHAW, *Sec-Treas.*

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